clude the presence or addition of one or more other features, integers, steps, operations, members, elements, and/or groups thereof.

[0052] Hereinafter, embodiments will be described with reference to schematic views illustrating various embodiments. In the drawings, for example, due to manufacturing techniques and/or tolerances, modifications of the shape shown may be estimated. Thus, embodiments should not be construed as being limited to the particular shapes of regions shown herein, for example, to include a change in shape results in manufacturing. The following embodiments may also be constituted by one or a combination thereof.

[0053] The various embodiments described below may have a variety of configurations and propose only a required configuration herein, but are not limited thereto.

[0054] In addition, a surface of each lens closest to an object is referred to as a first surface or an object-side surface, and a surface of each lens closest to an imaging surface is referred to as a second surface or an image-side surface. A first lens is a lens closest to an object (or a subject), while an eleventh lens or an eighth lens is a lens closest to an imaging plane (or an image sensor). A person skilled in the relevant art will appreciate that other units of measurement may be used. Further, in the present specification, all radii of curvature, thicknesses, OALs (optical axis distances from the first surface of the first lens to the image sensor (OALs), a distance on the optical axis between the stop and the image sensor (SLs), image heights or ½ of a diagonal length of the imaging plane (IMGHs) (image heights), and black focus lengths (BFLs) (back focus lengths) of the lenses, an overall focal length of an optical system, and a focal length of each lens are indicated in millimeters (mm). Further, thicknesses of lenses, gaps between the lenses, OALs, and SLs are distances measured based on an optical axis of the lenses. Further, thicknesses of the lenses, gaps between the lenses, and TTL, a through-the-lens, are distances in optical axes through the lenses. The TTL is a camera feature in which light levels are measured through the lens that captures the pictures, as opposed to a separate metering window.

[0055] Further, surface of a lens being convex means that an optical axis portion of a corresponding surface is convex, and a surface of a lens being concave means that an optical axis portion of a corresponding surface is concave. Therefore, even in the case that one surface of a lens is described as being convex, an edge portion of the lens may be concave. Likewise, even in the case that one surface of a lens is described as being concave, an edge portion of the lens may be convex. In other words, a paraxial region of a lens may be convex, while the remaining portion of the lens outside the paraxial region is either convex, concave, or flat. Further, a paraxial region of a lens may be concave, while the remaining portion of the lens outside the paraxial region is either convex, concave, or flat.

[0056] In the optical system, according to embodiments, the lenses are formed of materials including glass, plastic or other similar types of polycarbonate materials. In another embodiment, at least one of the lenses is formed of a material different from the materials forming the other lenses.

[0057] An optical imaging system includes an optical system including lenses. For example, the optical system of the optical imaging system may include lenses having refractive power. However, the optical imaging system is not limited to including only the lenses having refractive power. For example, the optical imaging system may include a stop to control an amount of light. In addition, the optical imaging system may further include an infrared cut-off filter filtering infrared light. Further, the optical imaging system may further include an image sensor, such as an imaging device, configured to convert an image of a subject incident thereto through the optical system into electrical signals. Further, the optical imaging system may further include a gap maintaining member adjusting a gap between lenses.

[0058] The lenses are formed of a material having a refractive index different from that of air. For example, the lenses are formed of plastic or glass. At least one of the lenses has an aspherical shape. An aspherical surface of each of the lenses is represented by the following Equation 1:

$$Z = \frac{cr^2}{1+\sqrt{1-(1+k)c^2r^2}} + Ar^4 + Br^6 + Cr^8 + Dr^{10} + Er^{12} + Fr^{14} + Gr^{16} + Hr^{18} + Jr^{20} \quad \text{[Equation 1]}$$

[0059] In this equation, c is an inverse of a radius of curvature of the lens, k is a conic constant, r is a distance from a certain point on an aspherical surface of the lens to an optical axis, A to J are aspherical constants, and Z (or SAG) is a distance between the certain point on the aspherical surface of the lens at the distance Y and a tangential plane meeting the apex of the aspherical surface of the lens.

[0060] The optical imaging system, in accordance with an embodiment, includes a plurality of lens groups. For example, the optical imaging system includes a first fixed lens group, a first movable lens group, a second movable lens group, and a second fixed lens group. The first fixed lens group, the first movable lens group, the second movable lens group, and the second fixed lens group are sequentially disposed from an object side toward the imaging plane.

[0061] The first fixed lens group includes one or more lenses. For example, the first fixed lens group includes a lens having a negative refractive power and a lens having a positive refractive power. The lens having the negative refractive power is adjacently disposed to an object-side surface of a prism, and the lens having the positive refractive power is adjacently disposed to an image-side surface of the prism.

[0062] The first movable lens group includes one or more lenses. For example, the first movable lens group includes three lenses. The three lenses are lenses having different refractive powers. For example, the first movable lens group includes two lenses having a negative refractive power and one lens having a positive refractive power. However, a combination of the lenses configuring the first movable lens group is not limited to the described example. In accordance with another example, the first movable lens group includes two lenses having positive refractive power and one lens having negative refractive power.

[0063] The second movable lens group includes one or more lenses. For example, the second movable lens group includes one lens having a negative refractive power. However, the second movable lens group is not limited to including only one lens. For example, the second movable lens group may include three lenses. In another configuration, the one lens has a positive refractive power.